FINAL

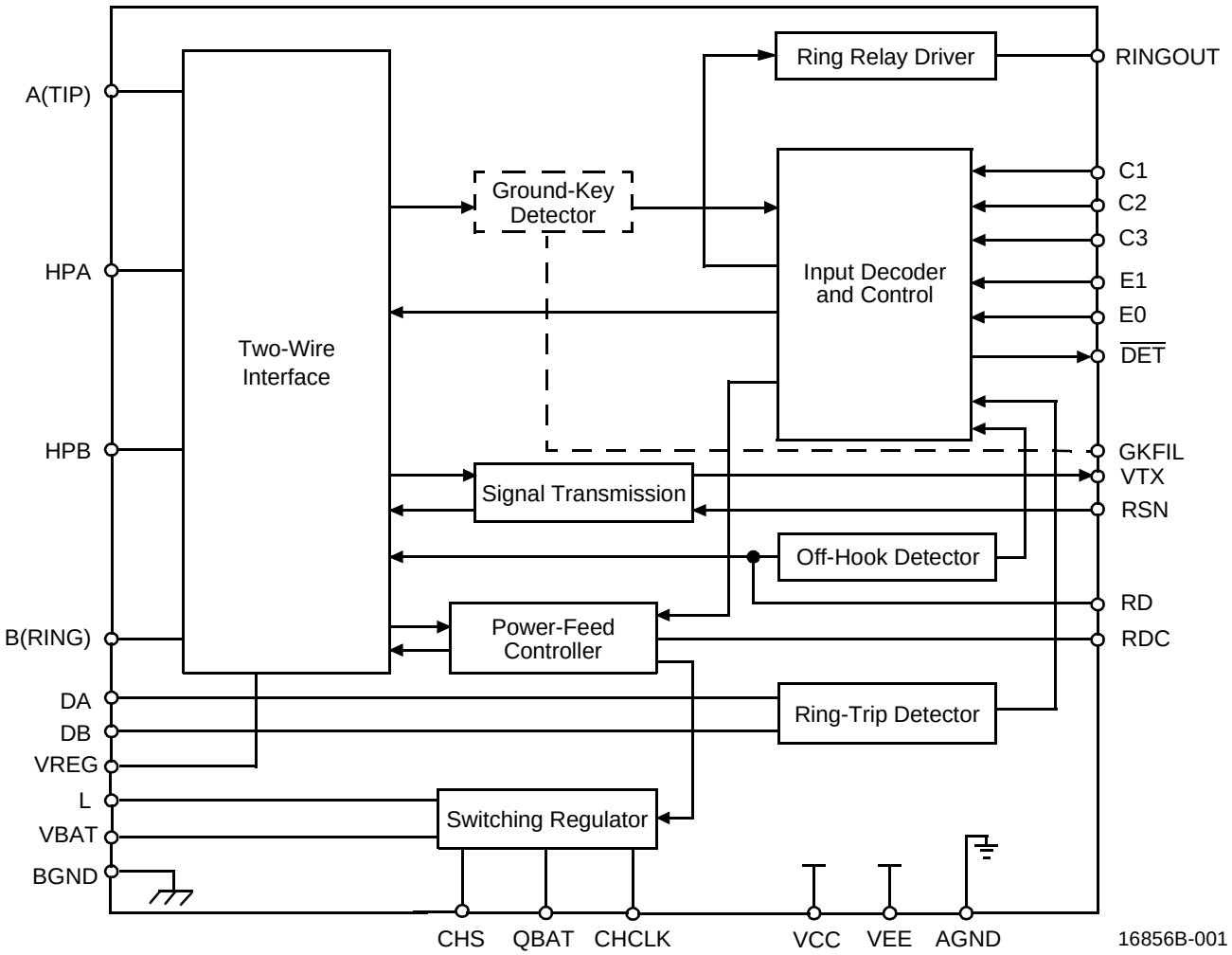
Am79M531/Am79M535

Metering Subscriber Line Interface Circuit

DISTINCTIVE CHARACTERISTICS

- **Programmable constant-current feed**
- **Line-feed characteristics independent of battery variations**
- **Programmable loop-detect threshold**
- **On-chip switching regulator for low-power dissipation**
- **Pin for external ground-key noise filter capacitor available**
- **Ground-key detect**
- **Two-wire impedance set by single external impedance**
- **Performs polarity reversal**
- **Tip Open state for ground-start lines**
- **Supports 2.2 Vrms metering (12 and 16 kHz)**
- **On-hook transmission**

BLOCK DIAGRAM



Notes:

1. *Am79M531—E0 and E1 inputs; ring relay driver sourced internally to BGND; no test relay driver; ground-key filter pin.*
2. *Am79M535—E0 and E1 inputs; ring relay driver sourced internally to BGND; ground-key filter pin.*
3. *Current gain (K_1) = 1000 for all parts.*

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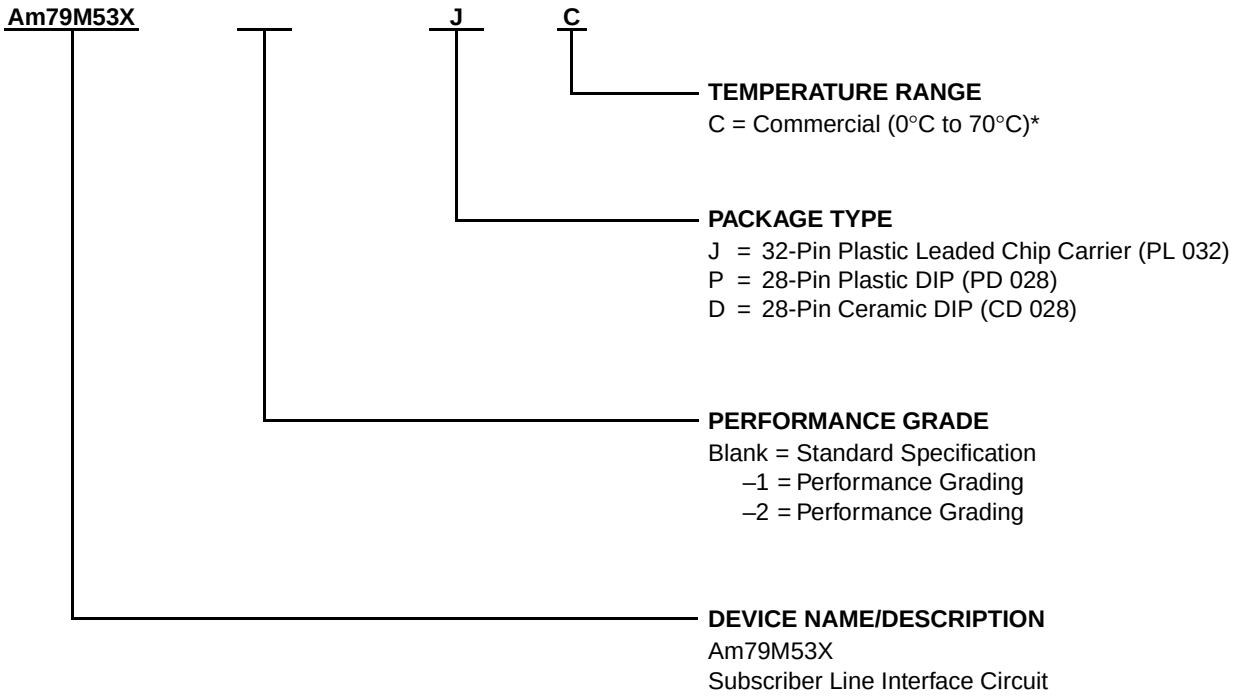
Issue Date: **July 1998**

ORDERING INFORMATION

Standard Products

AMD standard products are available in several packages and operating ranges. The order number (Valid Combination) is formed by a combination of the elements below.



Valid Combinations		
Am79M53X	–1 –2	DC JC PC

Valid Combinations

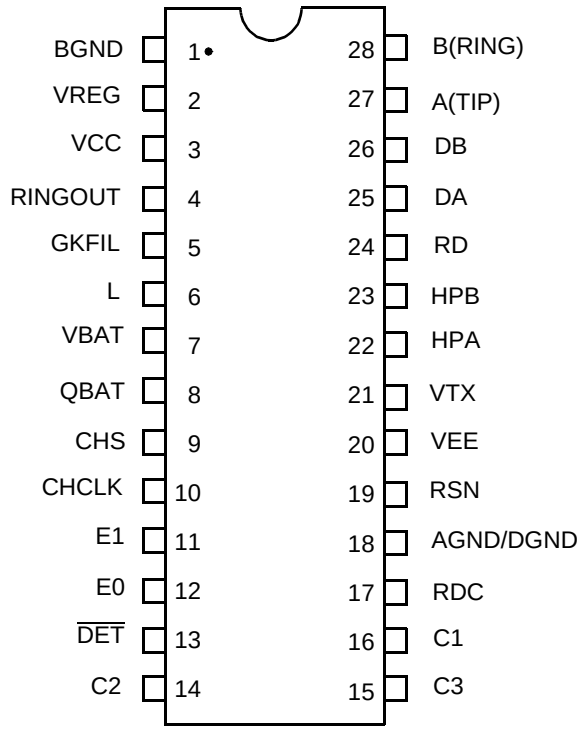
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

Note:
** Functionality of the device from 0°C to +70°C is guaranteed by production testing. Performance from –40°C to +85°C is guaranteed by characterizations and periodic sampling of production units.*

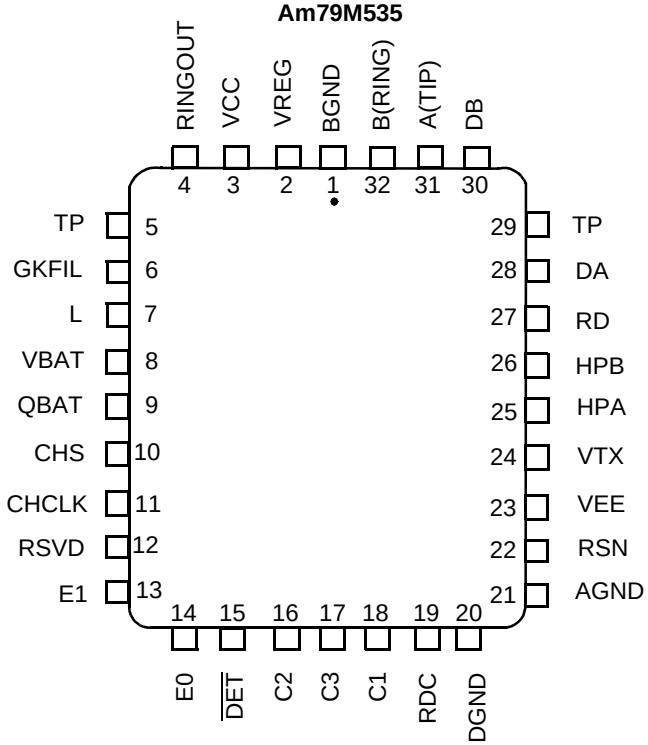
CONNECTION DIAGRAMS

Top View

Am79M531



Am79M535



Notes:

1. *Pin 1 is marked for orientation.*
2. *TP is a thermal conduction pin tied to substrate (QBAT).*
3. *RSVD = Reserved. Do not connect to this pin.*

PIN DESCRIPTIONS

Pin Names	Type	Description
AGND	Gnd	(Am79M535) Analog (quiet) ground.
DGND	Gnd	(Am79M535) Digital ground.
AGND/DGND	Gnd	(Am79M531) Analog and Digital ground.
A(TIP)	Output	Output of A(TIP) power amplifier.
BGND	Gnd	Battery (power) ground.
B(RING)	Output	Output of B(RING) power amplifier.
C3–C1	Inputs	Decoder. TTL compatible. C3 is MSB and C1 is LSB.
CAS	Capacitor	Anti-saturation pin for capacitor to filter reference voltage when operating in anti-saturation region.
CHCLK	Input	Chopper Clock. Input to switching regulator (TTL compatible). Freq = 256 kHz (nominal).
DA	Input	Ring-trip negative. Negative input to ring-trip comparator.
DB	Input	Ring-trip positive. Positive input to ring-trip comparator.
DET	Output	Detector. Logic Low indicates that the selected detector is tripped. Logic inputs C3–C1, E1, and E0 select the detector. Open-collector with a built-in 15 kΩ pull-up resistor.
E0	Input	Read Enable. A logic High enables $\overline{\text{DET}}$. A logic Low disables $\overline{\text{DET}}$.
E1	Input	Ground-Key Enable. When E0 is High, E1 = High connects the ground-key detector to $\overline{\text{DET}}$, and E1 = Low connects the off-hook or ring-trip detector to $\overline{\text{DET}}$.
GKFIL	Capacitor	Ground-Key Filter Capacitor Connection. An external capacitor for filtering out high-frequency noise from the ground-key loop can be connected to this pin. An internal 36 kΩ –20%, +40% resistor is provided to form an RC filter with the external capacitor. In versions which have a GKFIL pin, a 3.3 nF minimum capacitance must be connected from the GKFIL pin to ground.
HPA	Capacitor	High-Pass Filter Capacitor. A(TIP) side of high-pass filter capacitor.
HPB	Capacitor	High-Pass Filter Capacitor. B(RING) side of high-pass filter capacitor.
L	Output	Switching Regulator Power Transistor. Connection point for filter inductor and anode of catch diode. Has up to 60 V of pulse waveform on it and must be isolated from sensitive circuits. Keep the diode connections short because of the high currents and high di/dt.
QBAT	Battery	Quiet Battery. Filtered battery supply for the signal processing circuits.
RD	Resistor	Detector resistor. Detector threshold set and filter pin.
RDC	Resistor	DC feed resistor. Connection point for the DC feed current programming network. The other end of the network connects to the receiver summing node (RSN).
RINGOUT	Output	(Am79M531) Ring Signal Driver. Sourcing from BGND with internal diode to Q_{BAT}
RSN	Input	The metallic current (AC and DC) between A(TIP) and B(RING) is equal to 500 x the current into this pin. The networks that program receive gain, two-wire impedance, and feed current all connect to this node.
TP	Thermal	Thermal pin. Connection for heat dissipation. Internally connected to substrate (QBAT). Leave as open circuit or connected to QBAT. In both cases, the TP pins can connect to an area of copper on the board to enhance heat dissipation
VBAT	Battery	Connected to office battery supply through an external protection diode.
VCC	Power	+5 V power supply.
VEE	Power	–5 V power supply.
VREG	Input	Regulated Voltage. Provides negative power supply for power amplifiers, connection point for inductor, filter capacitor, and chopper stabilization.
VTX	Output	Transmit Audio. This output is 0.510 times the A(TIP) and B(RING) metallic voltage. VTX also sources the two-wire input impedance programming network.

ABSOLUTE MAXIMUM RATINGS

Storage temperature . . . . . –55°C to +150°C

V_{CC} with respect to AGND/DGND . . . –0.4 V to +7.0 V

V_{EE} with respect to AGND/DGND . . . +0.4 V to –7.0 V

V_{BAT} with respect to AGND/DGND . . . +0.4 V to –70 V

Note: *Rise time of V_{BAT} (dv/dt) must be limited to 27 V/µs or less when Q_{BAT} bypass = 0.33 µF.*

BGND with respect to
AGND/DGND . . . . . +1.0 V to –3.0 V

A(TIP) or B(RING) to BGND:
Continuous . . . . . –70 V to +1.0 V
10 ms (f = 0.1 Hz) . . . . . –70 V to +5.0 V
1 µs (f = 0.1 Hz) . . . . . –90 V to +10 V
250 ns (f = 0.1 Hz) . . . . . –120 V to +15 V

Current from A(TIP) or B(RING). . . . . ±150 mA

Voltage on RINGOUT. . . . . BGND to 70 V above Q_{BAT}

Current through relay driver . . . . . 60 mA

Voltage on ring-trip input
(DA and DB). . . . . V_{BAT} to 0 V

Current into ring-trip inputs . . . . . ±10 mA

Peak current into regulator
switch (L pin) . . . . . 150 mA

Switcher transient peak off
voltage on L pin . . . . . +1.0 V

C3–C1, E0, E1, CHCLK to
AGND/DGND . . . . . –0.4 V to V_{CC} + 0.4 V

Maximum power dissipation, (see note). . . . T_A = 70°C
In 28-pin ceramic DIP package . . . . . 2.58 W
In 28-pin plastic DIP package . . . . . 1.4 W
In 32-pin PLCC package . . . . . 1.74 W

Note: *Thermal limiting circuitry on chip will shut down the circuit at a junction temperature of about 165°C. The device should never be exposed to this temperature. Operation above 145°C junction temperature may degrade device reliability. See the SLIC Packaging Considerations for more information.*

Stresses above those listed under Absolute Maximum Ratings may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to Absolute Maximum Ratings for extended periods may affect device reliability.

OPERATING RANGES

Commercial (C) Devices

Ambient temperature . . . . . 0°C to +70°C*

V_{CC} . . . . . 4.75 V to 5.25 V

V_{EE} . . . . . –4.75 V to –5.25 V

V_{BAT} . . . . . –40 V to –58 V

AGND/DGND . . . . . 0 V

BGND with respect to
AGND/DGND . . . . . –100 mV to +100 mV

Load resistance on VTX to ground . . . . . 10 kΩ min

Operating Ranges define those limits between which the functionality of the device is guaranteed.

** Functionality of the device from 0°C to +70°C is guaranteed by production testing. Performance from –40°C to +85°C is guaranteed by characterizations and periodic sampling of production units.*

ELECTRICAL CHARACTERISTICS

Description	Test Conditions (See Note 1)		Min	Typ	Max	Unit	Note
Analog (V_{TX}) output impedance				3		W	4
Analog (V_{TX}) output offset	0°C to 70°C		–35		+35	mV	—
		–1*	–30		+30		—
	–40°C to +85°C		–40		+40		4
		–1	–35		+35		4
Analog (RSN) input impedance	300 Hz to 3.4 kHz			1	20	W	4
Longitudinal impedance at A or B					35		
Overload level	4-wire		–3.1		+3.1	Vpk	
Z_{2WIN} = 600 to 900 Ω	2-wire		–6.0		+6.0		2
Transmission Performance, 2-Wire Impedance							
2-wire return loss (See Test Circuit D)	300 Hz to 500 Hz 500 Hz to 2500 Hz 2500 Hz to 3400 Hz		26 26 20			dB	4, 13
Longitudinal Balance (2-Wire and 4-Wire, See Test Circuit C)							
R_L = 600 Ω, Longitudinal to metallic L-T, L-4 (normalized to unity gain)	300 Hz to 3400 Hz		48			dB	
		–1*	52				
Longitudinal to metallic L-T, L-4	200 Hz to 1 kHz						—
	normal polarity 0°C to +70°C	–2*	63				—
	normal polarity –40°C to +85°C	–2	58				4
	reverse polarity	–2	54				—
	1 kHz to 3.4 kHz						—
	normal polarity 0°C to +70°C	–2*	58				—
	normal polarity –40°C to +85°C	–2	54				4
	reverse polarity	–2	54				—
Longitudinal signal generation 4-L	300 Hz to 800 Hz		40				
	300 Hz to 800 Hz	–1*	42				
Longitudinal current capability per wire	Active state			25		mArms	4
	OHT state			18			4
Insertion Loss (2- to 4-Wire and 4- to 2-Wire, See Test Circuits A and B)							
Gain accuracy 2- to 4-wire	0 dBm, 1 kHz, 0°C to +70°C		5.75	5.85	6.00	dB	—
2- to 4-wire	0 dBm, 1 kHz, –40°C to +85°C		5.65	5.85	6.05		4
2- to 4-wire	0 dBm, 1 kHz, 0°C to +70°C	–1*	5.75	5.85	5.95		—
2- to 4-wire	0 dBm, 1 kHz, –40°C to +85°C	–1	5.70	5.85	6.00		4
Gain accuracy 4- to 2-wire	0 dBm, 1 kHz, 0°C to +70°C		–0.15		+0.15		—
4- to 2-wire	0 dBm, 1 kHz, –40°C to +85°C		–0.20		+0.20		4
4- to 2-wire	0 dBm, 1 kHz, 0°C to +70°C	–1*	–0.1		+0.1		—
4- to 2-wire	0 dBm, 1 kHz, –40°C to +85°C	–1	–0.15		+0.15		4
Variation with frequency	300 Hz to 3400 Hz Relative to 1 kHz						— —
	0°C to +70°C		–0.1		+0.1		—
	–40°C to +85°C		–0.15		+0.15		4
Gain tracking	+7 dBm to –55 dBm, ref 0 dBm						—
	0°C to +70°C		–0.1		+0.1		—
	–40°C to +85°C		–0.15		+0.15		4

Notes:

** P.G. = Performance Grade*

–2 grade performance parameters are equivalent to –1 performance parameters except where indicated.

ELECTRICAL CHARACTERISTICS (CONTINUED)

Description	Test Conditions (See Note 1)	Min	Typ	Max	Unit	Note
Balance Return Signal (4- to 4-Wire; See Test Circuit B)						
Gain accuracy	0 dBm, 1 kHz, 0°C to +70°C 0 dBm, 1 kHz, –40°C to +85°C 0 dBm, 1 kHz, 0°C to +70°C –1* 0 dBm, 1 kHz, –40°C to +85°C –1	–6.00 –6.05 –5.95 –6.00	–5.85 –5.85 –5.85 –5.85	–5.75 –5.65 –5.75 –5.70	dB	3 3, 4 3 3, 4
Variation with frequency	300 Hz to 3400 Hz Relative to 1 kHz 0°C to +70°C –40°C to +85°C	 –0.10 –0.15		 +0.10 +0.15	dB	— — 3, 4 3, 4
Gain tracking	+7 dBm to –55 dBm, ref 0 dBm 0°C to +70°C –40°C to +85°C	 –0.10 –0.15		 +0.10 +0.15	dB	— — 4
Group delay	f = 1 kHz		5.3		µs	4, 15
Total Harmonic Distortion (2- to 4-Wire or 4- to 2-Wire, See Test Circuits A and B)						
Total harmonic distortion	0 dBm, 300 Hz to 3.4 kHz +9 dBm, 300 Hz to 3.4 kHz		–64 –55	–50 –40	dB	
Total harmonic distortion with metering				–35	dB	4, 10
Idle Channel Noise						
C-message weighted noise	2-wire, 0°C to +70°C 2-wire, 0°C to +70°C –1* 2-wire, –40°C to +85°C		+7 +7 +7	+15 +12 +15	dBrnC	— — 4
	4-wire, 0°C to +70°C 4-wire, 0°C to +70°C –1* 4-wire, –40°C to +85°C		+7 +7 +7	+15 +12 +15	dBrnC	— — 4
Psophometric weighted noise	2-wire, 0°C to +70°C 2-wire, 0°C to +70°C –1* 2-wire, –40°C to +85°C		–83 –83 –83	–75 –78 –75	dBmp	7 — 4, 7
	4-wire, 0°C to +70°C 4-wire, 0°C to +70°C –1* 4-wire, –40°C to +85°C		–83 –83 –83	–75 –78 –75	dBmp	7 — 4, 7
Psophometric idle channel noise with metering	2-wire			–46	dBmp	4, 11
	4-wire			–52	dBmp	4, 11
Signal Frequency Out-of-Band Noise (See Test Circuit E)						
Metallic	4 kHz to 9 kHz 9 kHz to 1 MHz 256 kHz and harmonics			–76 –76 –57	dBm	4, 5, 9 4, 5, 9 4, 5
Longitudinal	1 kHz to 15 kHz Above 15 kHz 256 kHz and harmonics			–70 –85 –57	dBm	4, 5, 9 4, 5, 9 4, 5
DC Feed Currents (See Figure 1a, 1b, 1c) Battery = –48 V						
Active state loop-current accuracy	I_{LOOP} (nominal) = 40 mA	–7.5		+7.5	%	
OHT state	R_L = 600 Ω	18	20	22	mA	
Tip Open state	R_L = 600 Ω			1.0	mA	
Open Circuit state	R_L = 0 Ω			1.0	mA	
Fault current limit, I_LLIM (I_{AX} + I_{BX})	A and B shorted to GND			130	mA	

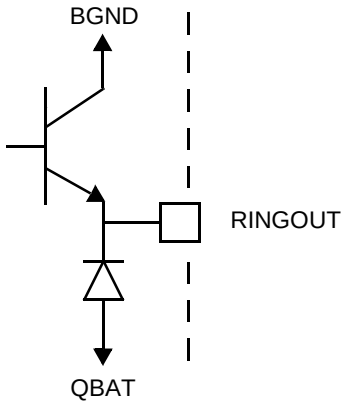
ELECTRICAL CHARACTERISTICS (CONTINUED)

Description	Test Conditions (See Note 1)	Min	Typ	Max	Unit	Note
Power Dissipation Battery = –48 V, Normal Polarity						
On-hook Open Circuit state	 –1*		35 35	120 80	mW	
On-hook OHT state	 –1*		135 135	250 200		
On-hook Active state	 –1*		200 200	400 300		
Off-hook OHT state	R_L = 600 Ω		500	750		
Off-hook Active state	R_L = 600 Ω		650	1000		
Supply Currents						
V_{CC} on-hook supply current	Open Circuit state OHT state Active state		3.0 6.0 7.5	4.5 10.0 12.0	mA	
V_{EE} on-hook supply current	Open Circuit state OHT state Active state		1.0 2.2 2.7	2.3 3.5 6.0		
V_{BAT} on-hook supply current	Open Circuit state OHT state Active state		0.4 3.0 4.0	1.0 5.0 6.0		
Power Supply Rejection Ratio (V_{RIPPLE} = 50 mVrms)						
V_{CC}	50 Hz to 3400 Hz –1*	25 30	45 45		dB	6, 7
	3.4 kHz to 50 kHz –1*	22 25	35 35			
V_{EE}	50 Hz to 3400 Hz –1*	20 25	40 40			
	3.4 kHz to 50 kHz –1*	10 10	25 25			
V_{BAT}	50 Hz to 3400 Hz –1	27 30	45 45			
	3.4 kHz to 50 kHz –1*	20 25	40 40			
Off-Hook Detector						
Current threshold accuracy	I_{DET} = 365/R_D Nominal	–20		+20	%	
Ground-Key Detector Thresholds, Active state, Battery = –48 V (See Test Circuit F)						
Ground-key resistance threshold	B(RING) to GND	2.0	5.0	10.0	kΩ	
Ground-key current threshold	B(RING) to GND		9		mA	8
	Midpoint to GND		9			
Ring-Trip Detector Input						
Bias current		–5	–0.05		µA	
Offset voltage	Source resistance 0 to 2 MΩ	–50	0	+50	mV	12
Logic Inputs (C4–C1, E0, E1, and CHCLK)						
Input High voltage		2.0			V	
Input Low voltage				0.80		
Input High current	All inputs except E1	–75		40	µA	
Input High current	Input E1	–75		45		
Input Low current		–0.40			mA	

ELECTRICAL CHARACTERISTICS (CONTINUED)

Description	Test Conditions (See Note 1)	Min	Typ	Max	Unit	Note
Logic Output ($\overline{DET}$)						
Output Low voltage	I_{OUT} = 0.8 mA			0.40	V	
Output High voltage	I_{OUT} = –0.1 mA	2.4				
Relay Driver Outputs (RINGOUT)						
On voltage	50 mA source	BGND –2	BGND –0.95		V	
Off leakage			0.5	100	µA	
Clamp voltage	50 mA sink	Q_{BAT} –2			V	

RELAY DRIVER SCHEMATIC



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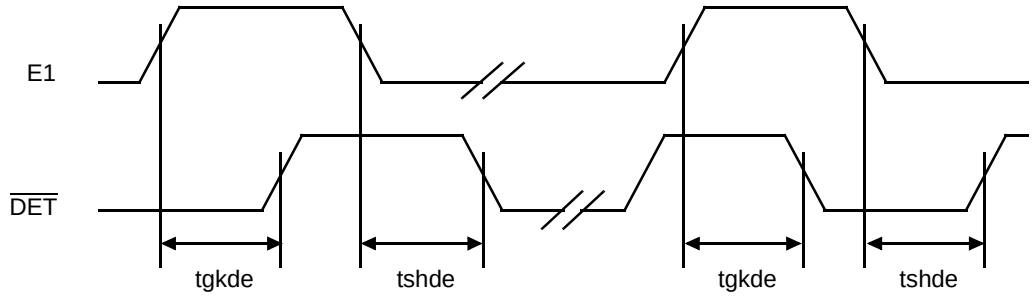
SWITCHING CHARACTERISTICS
AM79M531

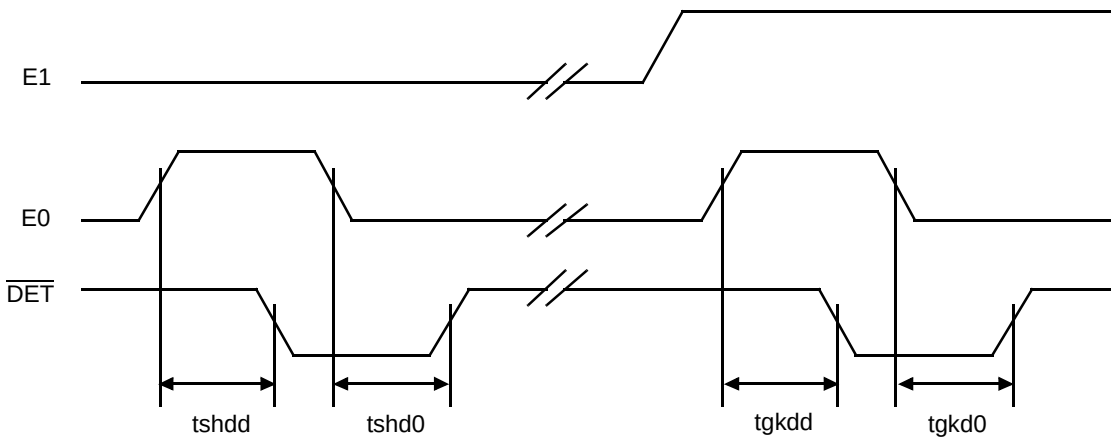
Symbol	Parameter	Test Conditions	Temperatures Ranges	Min	Typ	Max	Unit	Note
tgkde	E1 Low to $\overline{DET}$ High (E0 = 1)	Ground-Key Detect state R_L open, R_G connected (See Figure H)	0°C to +70°C –40°C to +85°C			3.8 4.0	µs	4
	E1 Low to $\overline{DET}$ Low (E0 = 1)		0°C to +70°C –40°C to +85°C			1.1 1.6		
tgkdd	E0 High to $\overline{DET}$ Low (E1 = 0)		0°C to +70°C –40°C to +85°C			1.1 1.6		
tgkd0	E0 Low to $\overline{DET}$ High (E1 = 0)		0°C to +70°C –40°C to +85°C			3.8 4.0		
tshde	E1 High to $\overline{DET}$ Low (E0 = 1)	Switchhook Detect state R_L = 600 Ω, R_G open (See Figure G)	0°C to +70°C –40°C to +85°C			1.2 1.7		
	E1 High to $\overline{DET}$ High (E0 = 1)		0°C to +70°C –40°C to +85°C			3.8 4.0		
tshdd	E0 High to $\overline{DET}$ Low (E1 = 1)		0°C to +70°C –40°C to +85°C			1.1 1.6		
tshd0	E0 Low to $\overline{DET}$ High (E1 = 1)		0°C to +70°C –40°C to +85°C			3.8 4.0		

SWITCHING WAVEFORMS

E1 to $\overline{\text{DET}}$



E0 to $\overline{\text{DET}}$



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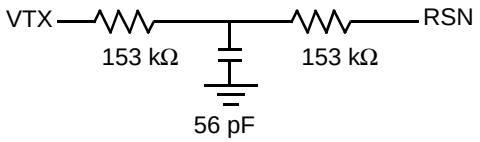
Note:
All delays measured at

Notes:

1. *Unless otherwise noted, test conditions are BAT = –48 V, V_{CC} = +5 V, V_{EE} = –5 V, R_L = 600 Ω, C_{HP} = 0.22 µF, R_{DC1} = R_{DC2} = 31.25 kΩ, C_{DC} = 0.1 µF, R_d = 51.1 kΩ, no fuse resistors, two-wire AC output impedance, programming impedance (Z_T) = 306 kΩ resistive, receive input summing impedance (Z_{RX}) = 300 kΩ resistive. (See Table 2 for component formulas.)*
2. *Overload level is defined when THD = 1%.*
3. *Balance return signal is the signal generated at V_{TX} by V_{RX}. This specification assumes that the two-wire AC load impedance matches the impedance programmed by Z_T.*
4. *Not tested in production. This parameter is guaranteed by characterization or correlation to other tests.*
5. *These tests are performed with a longitudinal impedance of 90 Ω and metallic impedance of 300 Ω for frequencies below 12 kHz and 135 Ω for frequencies greater than 12 kHz. These tests are extremely sensitive to circuit board layout.*
6. *This parameter is tested at 1 kHz in production. Performance at other frequencies is guaranteed by characterization.*
7. *When the SLIC is in the Anti-sat 2 operating region, this parameter is degraded. The exact degradation depends on system design. The Anti-sat 2 region occurs at high loop resistances when $|V_{BAT}| - |V_{AX} - V_{BX}|$ is less than approximately 17 V.*
8. *"Midpoint" is defined as the connection point between two 300 Ω series resistors connected between A(TIP) and B(RING).*
9. *Fundamental and harmonics from 256 kHz switch-regulator chopper are not included.*
10. *Total harmonic distortion with metering as specified with a metering signal of 2.2 Vrms at the two-wire output, and a transmit signal of +3 dBm or receive signal of –4 dBm. The transmit or receive signals are single-frequency inputs, and the distortion is measured as the highest in-band harmonic at the two-wire or the four-wire output relative to the input signal.*
11. *Noise with metering is measured by applying a 2.2 Vrms metering signal (measured at the two-wire output) and measuring the psophometric noise at the two-wire and four-wire outputs over a 200 ms time interval.*
12. *Tested with 0 Ω source impedance. 2 MΩ is specified for system design purposes only.*
13. *Assumes the following Z_T network:*



14. *Group delay can be considerably reduced by using a Z_T network such as that shown in Note 13 above. The network reduces the group delay to less than 2 µs. The effect of group delay on linecard performance may be compensated for by using the QSLAC™ or DSLAC™ devices.*

Table 1. SLIC Decoding

					$\overline{\text{DET}}$ Output	
State	**C3**	**C2**	**C1**	**Two-Wire Status**	**E0 = 1* E1 = 0**	**E0 = 1* E1 = 1**
0	0	0	0	Open Circuit	Ring trip	Ring trip
1	0	0	1	Ringing	Ring trip	Ring trip
2	0	1	0	Active	Loop detector	Ground key
3	0	1	1	On-hook TX (OHT)	Loop detector	Ground key
4	1	0	0	Tip Open	Loop detector	—
5	1	0	1	Reserved	Loop detector	—
6	1	1	0	Active Polarity Reversal	Loop detector	Ground key
7	1	1	1	OHT Polarity Reversal	Loop detector	Ground key

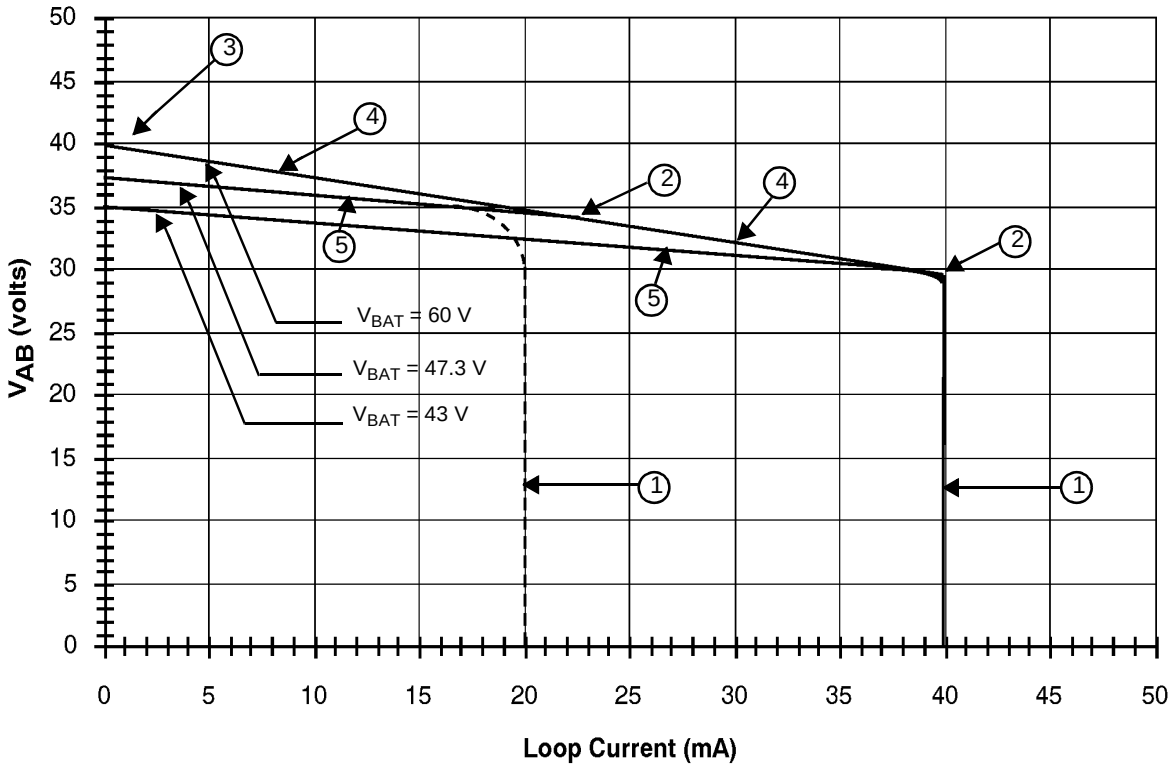
Note:

** A logic Low on E0 disables the $\overline{DET}$ output into the open-collector state.*

Table 2. User-Programmable Components

$Z_T = 510(Z_{2WIN} - 2R_F)$	Z_T is connected between the VTX and RSN pins. The fuse resistors are R_F, and Z_{2WIN} is the desired 2-wire AC input impedance. When computing Z_T, the internal current amplifier pole and any external stray capacitance between VTX and RSN must be taken into account.
$Z_{RX} = \frac{Z_L}{G_{42L}} \bullet \frac{1000 \bullet Z_T}{Z_T + 510(Z_L + 2R_F)}$	Z_{RX} is connected from V_{RX} to the RSN pin, Z_T is defined above, and G_{42L} is the desired receive gain.
$R_{DCI} + R_{DC2} = \frac{2500}{I_{FEED}}$ $C_{DC} = 1.5\ ms \bullet \frac{R_{DC1} + R_{DC2}}{R_{DC1} \bullet R_{DC2}}$	R_{DC1}, R_{DC2}, and C_{DC} form the network connected to the RDC pin. R_{DC1} and R_{DC2} are approximately equal.
$R_D = \frac{365}{I_T}, \quad C_D = \frac{0.5\ ms}{R_D}$	R_D and C_D form the network connected from RD to –5 V and I_T is the threshold current between on hook and off hook.
$Z_M = \frac{V_{MG}}{V_{M2W}} \bullet \frac{K_1(\omega) \bullet Z_L \bullet Z_T}{Z_T + 0.51 \bullet K_1(\omega)(2R_F + Z_L)}$	Z_M is connected from V_{MG} (metering source) to the RSN pin, V_{M2W} is the desired magnitude of the metering signal at the 2-wire output (usually 2.2 Vrms) and $K_1(\omega)$ is defined below. $K_1(\omega) = \frac{1000}{1 + j\omega(11.5 \bullet 10^{-9} + CX/2)(36 + Z_L + 2R_F)}$ where: CX = The values of the identical capacitors from A and B to GND $\omega = 2\pi \bullet$ metering frequency

DC FEED CHARACTERISTICS



Notes:

1. *Constant-current region:*

   Active state, $I_L = \frac{2500}{R_{DC}}$

   OHT state, $I_L = \frac{1}{2}\ \frac{2500}{R_{DC}}$

2. *Anti-sat turn-on;*

   $V_{AB} = 1.02\ |V_{BAT}| - 14, \quad |V_{BAT}| < 43.1$ V (Anti-sat –2)

   $V_{AB} = 29.95$ V, $|V_{BAT}| \geq 43.1$ V (Anti-sat –1)

3. *Open Circuit voltage;*

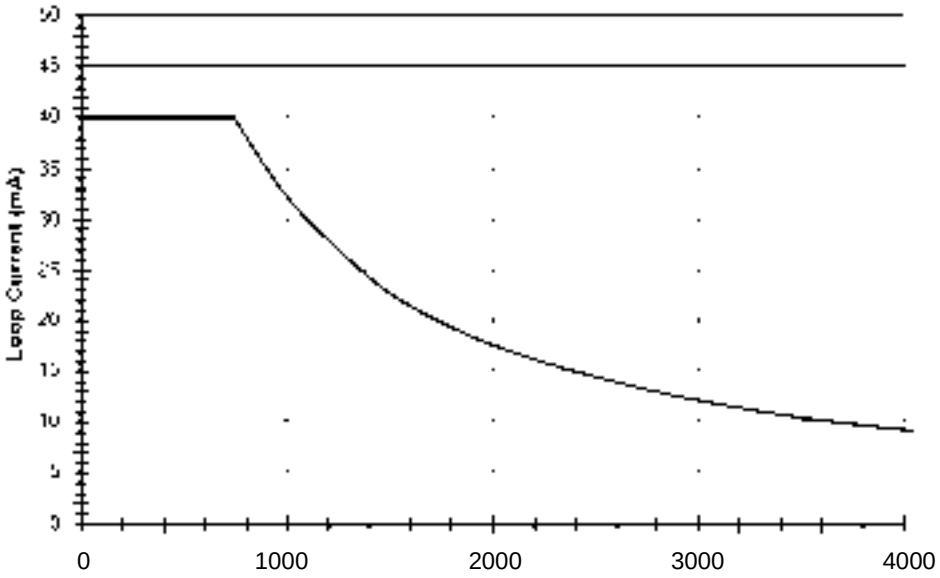
   $V_{AB} = 0.55\ |V_{BAT}| + 11.4, \quad |V_{BAT}| \leq 53$ V (Anti-sat –2)

   $V_{AB} = 40$ V, $|V_{BAT}| > 53$ V (Anti-sat –1)

4. *Anti-sat –1 region*

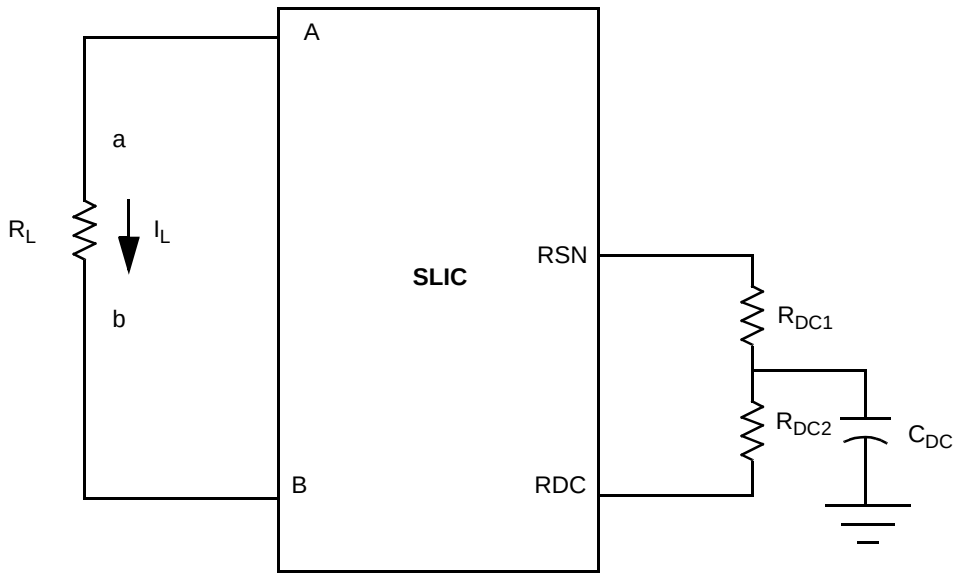
5. *Anti-sat –2 region*

a. V_A–V_B (V_{AB}) Voltage vs. Loop Current (Typical)



R_{DC} = 62.5 kΩ
V_{BAT} = 47.3 V

b. Loop Current vs. Load Resistance (Typical)



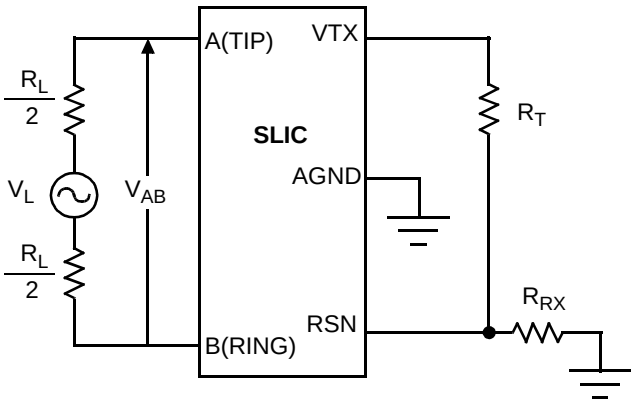
Current programmed by R_{DC1} and R_{DC}

c. Feed Programming

16856B-004

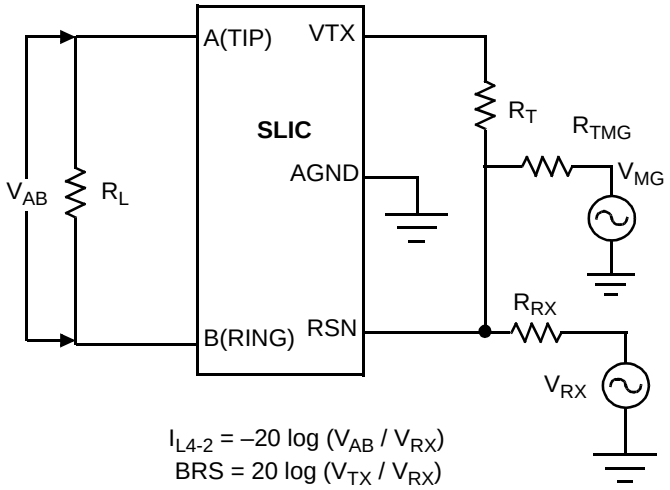
Figure 1. DC Feed Characteristics

TEST CIRCUITS



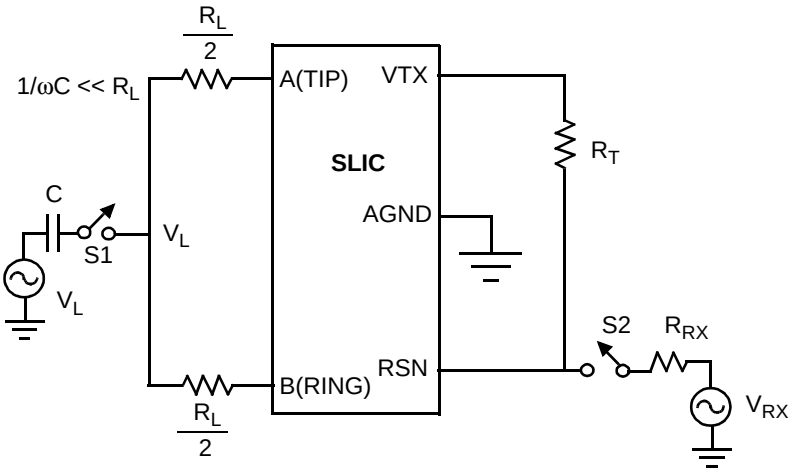
$I_{L2-4} = -20 \log (V_{TX} / V_{AB})$

A. Two- to Four-Wire Insertion Loss



$I_{L4-2} = -20 \log (V_{AB} / V_{RX})$
$BRS = 20 \log (V_{TX} / V_{RX})$

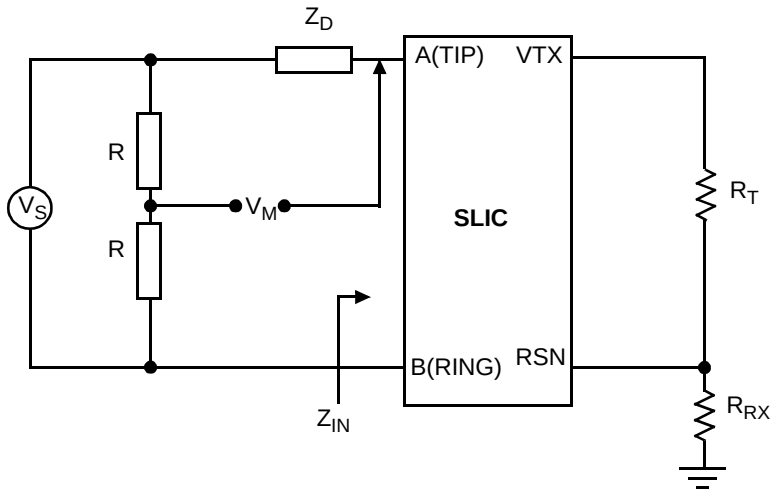
B. Four- to Two-Wire Insertion Loss and Balance Return Signal



S1 Closed, S2 Open
L-T Long. Bal. = $-20 \log (V_{AB} / V_L)$
L-4 Long. Bal. = $-20 \log (V_{TX} / G_{TX} \bullet V_L)$

S2 Closed, S1 Open
4-L Long. Sig. Gen. = $-20 \log (V_L / V_{RX})$

C. Longitudinal Balance

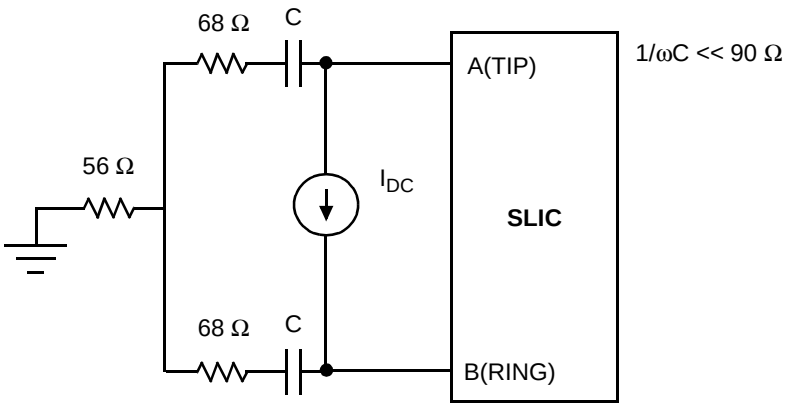


Note:
Z_D is the desired impedance (e.g., the characteristic imped-

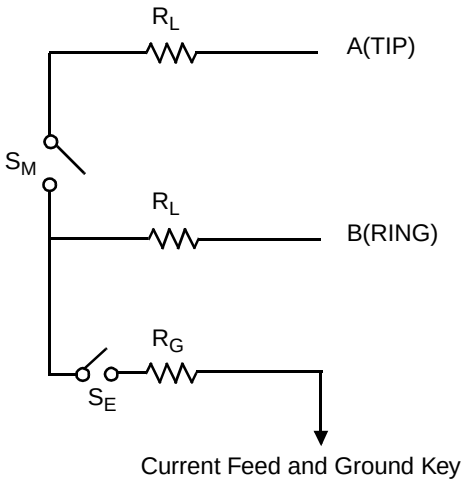
$R_L = 20 \log (2 V_M / V_S)$

D. Two-Wire Return Loss Test Circuit

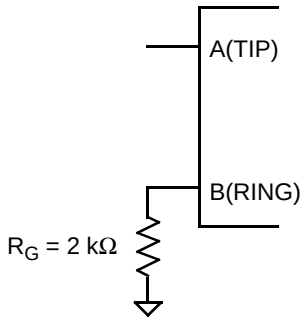
TESTS CIRCUITS (continued)



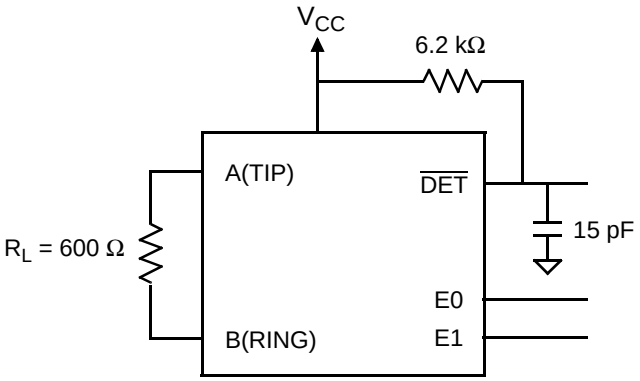
E. Single-Frequency Noise



F. Ground-Key Detection



G. Ground-Key Switching



H. Loop-Detector Switching

REVISION SUMMARY

Revision B to C

- Minor changes were made to the data sheet style and format to conform to AMD standards.

Revision C to D

- In Pin Description table, inserted/changed TP pin description to: “Thermal pin. Connection for heat dissipation. Internally connected to substrate (QBAT). Leave as open circuit or connected to QBAT. In both cases, the TP pins can connect to an area of copper on the board to enhance heat dissipation.”
- Minor changes were made to the data sheet style and format to conform to AMD standards.